Sustainable Management of Airports: A study in Indian context with focus on People, Planet and Prosperity

Synopsis

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Section I

Introduction

Transportation: Meaning, Importance and Modes

Transportation means moving goods and people from one location to another. A transportation facility is an urban object designated to facilitating the movement of people, cattle, animals and goods from one location to another. Transportation is facilitated by transport infrastructure *(https://securipedia.eu/,2013).* A country advances ahead relying on its transport infrastructure. The importance of the transport comes from the fact that it gives mobility to a nation, facilitates trade, commerce and facilitates engagement between people. With globalization, the importance of transport as a factor for eco nomic and social development has taken a new direction. Transport infrastructure facilitates the development of connections between regions within a country and between countries and consequently, it supports the formation of mutual economic, social, cultural relations *(Skorobogatova & Kuzmina-Merlino, 2017).*

Transportation is a crucial component of every economy since it enables the transport of resources from one location to the other, enabling people and societies to produce welfare. Efficient transport system in a country provide economic and social opportunities while deficient transport systems leads to missed opportunities and poor quality of life *(Rodrigue, 2016).* Transportation is divided into private and public transport. An important distinction in the type of transport is mode of transport. Transport modes are the means to achieve mobility. Transport modes are designed to either carry passengers or freight but most modes can carry a combination of both. The different modes are, Road transportation, Rail transportation and pipelines, Maritime transportation, Air transportation.

Air transportation System

Air transport plays a key role in the modern and global economies. Air Transport industry is the global network of commercial aircraft operators, airports, air navigation service providers and manufacturers of aircraft and their components. It is responsible for connecting the global economy, providing millions of jobs. It also provides excellent facilities and comfort to the passengers. The air transport system comprises of Airports, Air Traffic System and Airlines. The airports form the ground part of the system. The airports manage the flow of passenger/goods through the terminal and coordinates the movement of the aircraft operated by different airlines. It provides an interface between land and air transport. The ATC is the air

part of system and manages the controlled airspace between airports. It guides the aeroplane in air and while on ground to move safely. The airlines are operators of aircrafts and are carriers of passengers and goods. Aviation is best way to cover longest distance in a fast manner *(Schmitt & Gollnick, 2016)*. It may be noted that air transport needs a transport mode change before and after the air part of the journey and this adds another 30 min to 2 hours or more to the overall journey time. This additional journey time explains why air transport is best suited for distances longer than 500 kms. The importance of air transport and its relevance in terms of socio-economic benefits can be understood by the fact that the aviation industry creates millions of direct and indirect employment opportunities *(Teodorovic & Janic, 2016)*. It therefore has a huge impact on GDP of any country. The industry generates a total of 29 million jobs globally *(ICAO, 2011)*

The Aviation Industry

The Scenario: Global and Indian

The global aviation industry is growing fast. *International Air Transport Association (IATA)* has forecasted that global air travel will increase from around 5 billion annually to 8.2 billion over the next twenty years. Airline sector is characterized with low profit margin. The airports depend for their survival on air traffic movements and need to constantly evolve and innovate to survive and remain profitable in an extremely volatile environment. The enormous size of the industry is reflected by the fact that in 2019, 4.5 billion passengers used air transport generating revenue of $612 Billion (Only airlines revenue data). The aviation market is largely divided into six divisions which are, 1) North America, 2) Asia Pacific, 3) Europe, 4) South America, 5) Middle East and 6) Africa. Air transport will increase in future due to globalization and better technologies. Aircraft will become more energy efficient, safe and quieter. The industry will need more airplanes, trained pilots, skilled crew and other elements of the aviation supply chain. It will also need to expand its base of critical transport infrastructure i.e, Airports. India is currently the 5th largest market in world in terms of aircraft passengers (domestic and international). India is also forecasted to become 3rd largest aviation market after China and US by the year 2025 *(IATA, 2019).*

Evolution of Indian Airports:

The International Airports Authority of India (IAAI) and the National Airports Authority of India (NAAI) were merged in April 1995 by an Act of Parliament to form Airports Authority of India (AAI). It is

responsible for developing, financing, operating and maintaining all Government airports. Until early 2000, AAI was the only major player involved in developing and upgrading airports in India. India has 464 airports (includes airstrips). Out of this Airports Authority of India (AAI) manages 125 airports and balance are non-AAI managed. Out of125 airports, 90 are operational and out of these, 66 are domestic,17 are international and 7 are customs. The main airports in India are Delhi, Mumbai, Bengaluru, Chennai and Kolkata handling 67.3 Mn, 45.9 Mn, 32.4 Mn, 22.3 Mn and 22.2 Mn passengers respectively in FY 20 *(AAI, 2020)*. Presently, India has 5 PPP (Public Private Participation) airports, one each at Mumbai, Delhi, Cochin, Hyderabad and Bengaluru, which together handle over 55 percent of the country's air traffic. Indian plans to open 100 additional airports by 2024. Indian carriers are projected to increase their fleet size to 1,100 aircraft by 2027. AAI plans to invest Rs 25,000 crore (US$ 3.58 billion) in next the five years to augment facilities and infrastructure at airports *(IBEF, 2020).* In India, airports sector is dominated by public sector organization, AAI and private sector organizations: GMR Group, GVK group, The Fairfax group (Canada) who are running major airports in India through a Public Private Partnership. Adani enterprises and Zurich Airport have entered the market recently by winning bids to build/operate airports in India. The scenario is changing by the entry of new players and because of efforts by government to build and operate more and more airports by way of privatization. Water Aerodrome is a massive open area that is used by seaplanes or amphibious aircraft to land or take off. Water aerodromes can be built at much less cost and time than the land airport. A network of water aerodromes along with land-based airports will improve air connectivity. A total of 10 water aerodromes are being developed at an estimated total cost of Rs 330 Cr.

Regulatory and Governing Bodies for Airport: World and India

The International Civil Aviation Organization (ICAO): ICAO is a UN specialized agency, established by States in 1944 to manage the administration and governance of the Convention on International Civil Aviation (Chicago Convention). ICAO works with the Convention's 193 Member States and industry groups to reach consensus on international civil aviation Standards and Recommended Practices (SARPs) and policies in support of a safe, efficient, secure,conomically sustainable and environmentally responsible civil aviation sector.

The International Air Transport Association (IATA): IATA is the trade association for the world's airlines, representing around 290 airlines or 82% of total air traffic.

The Ministry of Civil Aviation (MoCA), India: MoCA is responsible for devising the policies and programmes for the development and regulation of the Civil Aviation sector in India.

Directorate General of Civil Aviation (DGCA): The Directorate General of Civil Aviation (DGCA) is the regulatory body in the field of Civil Aviation and mainly deals with safety issues.

Bureau of Civil Aviation Security (BCAS): The main responsibilities of BCAS include laying down standards and measures with respect to security of civil flights at international and domestic airports in India.

Airports Economic Regulatory Authority of India (AERA): It is formed by an Act- The Airports Economic Regulatory Authority of India Act, 2008. AERA was set up to regulate tariff for the aeronautical services, determine other airport charges for services rendered at major airports and to monitor the performance standards of such airports.

Section II

Literature Review

A review of the relevant literature in the current area of research is detailed in this section. A taxonomical view of the literature review conducted in this synopsis is given in figure below:

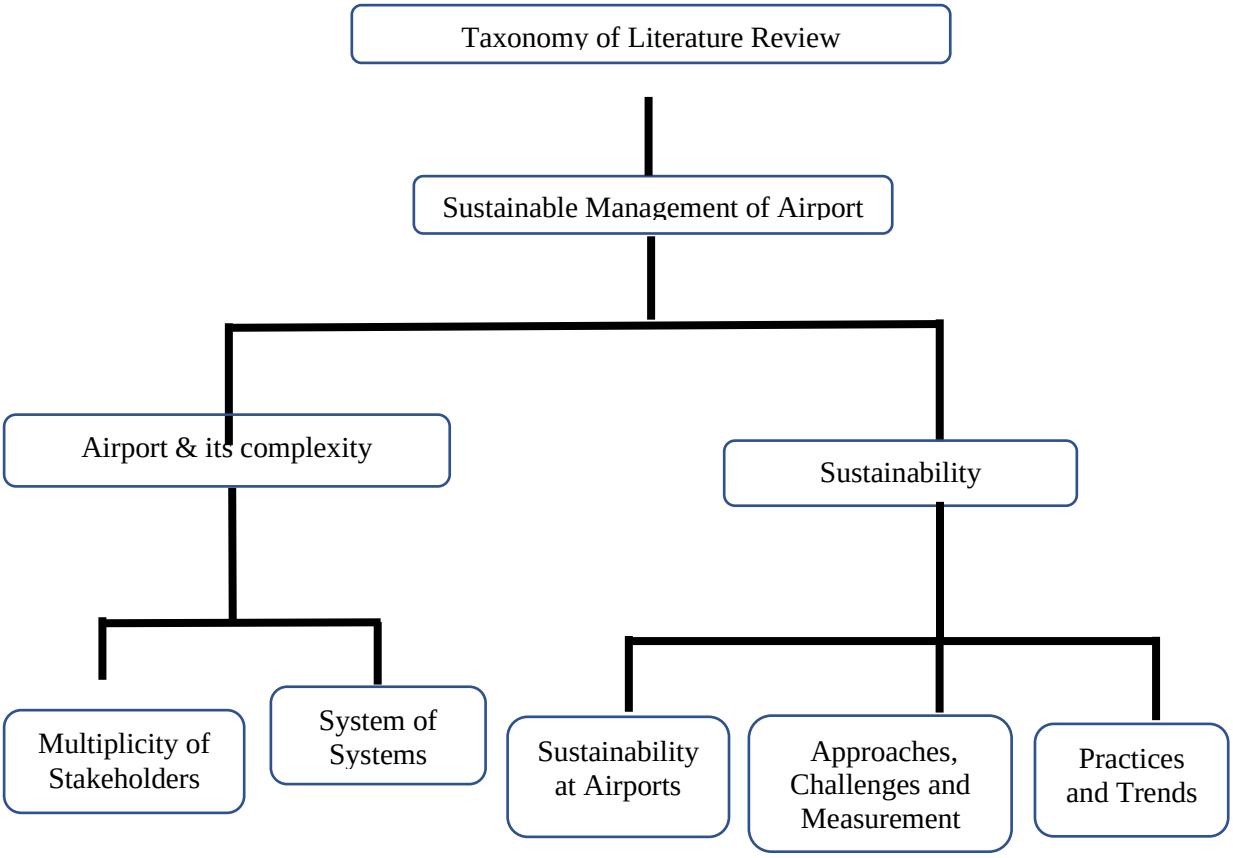

Figure 1: Taxonomy of Literature Review

Airport and Its Complexity

Airports provide regional businesses connectivity and help enhance the quality of life of people by providing access to safe and secure air transportation services. In India, Government of India operates the airports directly through Airports Authority of India (AAI) or as Public Private Partnership (PPP) as a public utility and national asset. Airport Operators are obligated to balance the interests of all the involved stakeholders and for ensuring that the stakeholders, partners and providers collaborate with each other to deliver seamless, safe and secure service to the consumer. The boundaries between various stakeholders and their roles and responsibilities are highly ambiguous in the context of airport operations. Consequently, there is very high level of complexity of operations in an airport. Air Transport is a highly complex system consisting of many complex systems within it. Each stakeholder in Air Transport System, provides some infrastructures and controls few processes to make the system run efficiently. The passenger is looking at seamless integrated performance of elements during travel. The various elements of the Air Transport System come together and integrate in various ways. Integration is a very critical part and characteristic of a large complex system. Decomposition of the involved system to the level of

component by thorough analysis and integration of components, susbsystem, substructures again integrates to a large complex system. Airports are the interface between land and air transport, which provide the infrastructure for this interface *(Schmitt & Gollnick, 2016)*.It must take care of the seamless flow of passengers and ensure efficiency and safety in the handling of aircraft, passengers and baggage. The other important role is to create Retail, entertainment and dining (RED) infrastructure and offer a great experience to the customers. The complexity in the infrastructure justifies the long time it takes to plan, design and to get it commissioned for operations (usually 5-10 years). The complexity of a modern airport includes meeting **predictable demands** and **unpredictable demands**. Predictable demands include things like, efficiently managing passengers and baggage flow, provide safe and secure operations, catering to F&B and shopping needs, and providing comfort and entertainment for waiting passengers. Unpredictable demands include managing delays from other airports as well as handling major disruptions due to weather and nature related disturbances. Complexity of Airport Operations leads to greater need of Airport Collaborative Decision Making Approach (ACDM).

Multiplicity of Airport Stakeholders

A stakeholder is any group or individual who can affect or is affected by the achievement of the organization's objectives. There are different classes of stakeholders that can be identified based on possession of any of the attributes as mentioned herein: a) stakeholder's power to influence the firm b) legitimacy of the stakeholder's relationship with the firm, and b) the urgency of the stakeholder's claim on the firm *(Mitchell, Agle, & Wood, 1997)*. A firm, thus, has different levels of relationship with each stakeholder and in the airport context, following stakeholder groups can be looked at:

1. Passengers: As per *Michael Cintron of International Air Passengers Association*, the airport's key goal is to move passengers quickly and comfortably to where they need to go. Therefore, ensuring on-time performance is one of the most important aims and objectives of any airport *(Schaar & Sherry, 2010)*.
2. Business and other Organizations who use airort either directly or indirectly.
3. Airlines: includes Passenger and Cargo Air carriers.
4. Other Aviation users: Air Taxi, Air ambulances, rental services etc.
5. Airport Organization: Airport is generally governed by a board comprising of government

representative and/or private investor groups.

6. Investors in the airport organization

7. Concessionaires and service providers/suppliers/contractors: The concessionaires as per agreement with the airport operator, are responsible for providing various passenger services in terminal buildings, airside, or landside. This includes ground handling services, parking management, food and beverage services, retail services, and hotels. Concession operators pay the airport organization a fixed annual fee and/or a percentage of gross revenues.

8. Employees: Employees working for airport or other organizations in airport areas.

9. Central Government and State Government

10. Communities Living around airport which are affected by airport operations

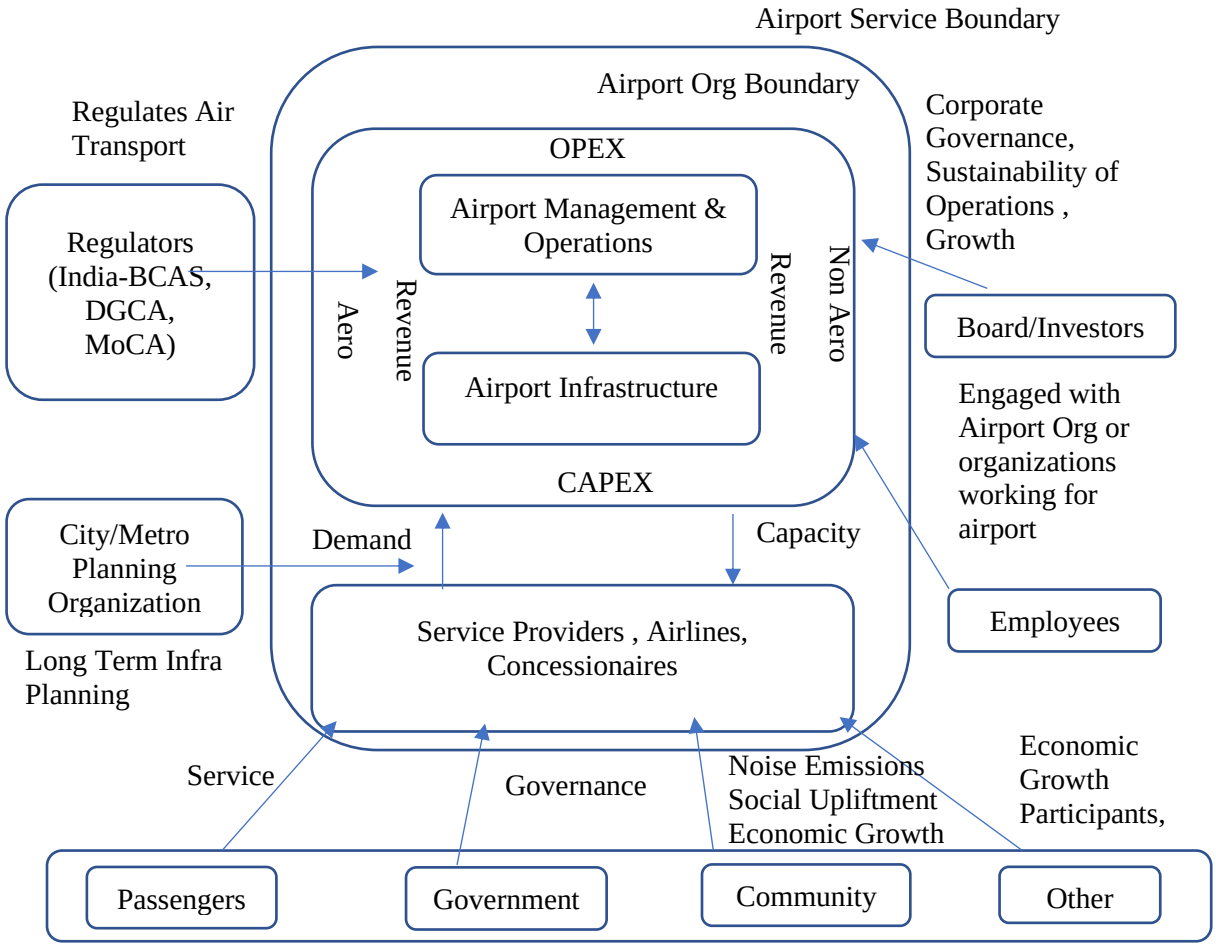

Figure 2: Complexity of Airport Infrastructure

The aforesaid set of stakeholders are into a complex web of relationships thereby making, airport management and operations overall, a system with high complexity. Airport Organization has an

organizational boundary and creates a service boundary when looked at along with its service providers and concessionaires. Passengers interact with service providers and concessionaires as well as airport organization, while using the airport infrastructure. Airport boundary carves out what is controlled by airport organization which mainly includes design, operational procedures and efficiency of own organization. The complexity lies in the fact that airport organization is ultimately responsible for seamless passenger experience as per defined service levels, but doesn't directly control all the processes *(Schaar & Sherry, 2010).*

Airport: Running a System of Systems

Airports are highly complex systems. They give access to infrastructure and services for the operations of airline and help manage the passengers and cargo. This requires airside set up including a runway, apron, and terminal facilities for passengers, cargo, general aviation, and maintenance and repairs facility as well. Also required are other functions like facilitation for car parking, utilities, and other nonaeronautical aspects like retail and Food and beverage arrangements. These are multifaceted in nature and have long lead times as well as involve high cost to plan, build and maintain *(Vogel, 2019).*

The many stakeholders of the airport organization have differing ambitions, divergent and competing interests, values and priorities along with overlapping jurisdictional boundaries. We can term this complex situation in airports as comprising of various interfaces that leads us to ultimately managing the interfaces *(Stevens, Baker, & Freestone, 2010)*. Group of researchers from Hanoi University and Deakin University proposed the concept of System of Systems (SoS). Airport can be visualized as a System of Systems (SoS). The attributes that describe a system of systems are operation and managerial independence, geographic isolation and emergent behaviour. These attributes can now be used to describe airport operations as a system of systems, as follows:

- ✓ **Operational Independence:** Passenger services are able to operate without freight and vice versa, but the combination of both provides a better economic situation.
- ✓ **Managerial Independence:** Services at the airport are provided by independent companies which are managed with no interference from airport organization.
- ✓ **Geographical Distribution:** While not separated by large distances, airport services are typically

treated as isolated. Passenger screening and baggage services exist within the concourse while cargo operations take place within the airport grounds.

✓ **Emergent Behaviour:** Through the sharing of common resources, more efficient operations can be achieved within the individual sub-systems.

Due to these unique attributes of an airport, there lies an opportunity to predict their eventual behaviour as the individual systems change, causing changes in the larger system of systems. Meaning thereby, we can identify the impact of new initiatives, strategies towards sustainable airport operations and validate the changes and impact on other related systems *(Nahavandi, Creighton, Johnstone, & Le, 2009)*.

Sustainability

The United Nations Environmental Program, 1972 in their conference on environment, met in Stockholm to emphasize the criticality of changes in ecological systems. It was articulated that human beings in their quest for economic development and enjoyment of riches of nature, must come to terms with the reality of resource limitation and the carrying capacities of ecosystems, and must take into account the needs of future generations *(IUCN, 1980)*. The increasing concern due to deteriorating environment conditions, triggered an action from Mr Brundtland, a former Prime Minister of Norway as a member of UN and he presided over the World Commission on Environment and Develop*ment (WCED)*. The outcome was famous report named as *Our Common Future (Brundtland, 1987*). The report defined Sustainable Development as a development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In 1992, United Nations Conference on Environment and Development further pressed the importance of sustainable development and that people on this earth were entitled to a healthy and productive life in harmony with nature. With the increase in the use of technology and knowledge of its effects on the environment, there has come a sharper awareness of how isolated and individual actions can affect the collective well-being. The triple bottom line concept states that there are values, issues and processes that companies must address in order to minimize any harm resulting from their activities *(Elkington, 2020)*. This framework went beyond the traditional measures of profits, return on investment, and shareholder value to include environmental and social dimensions.

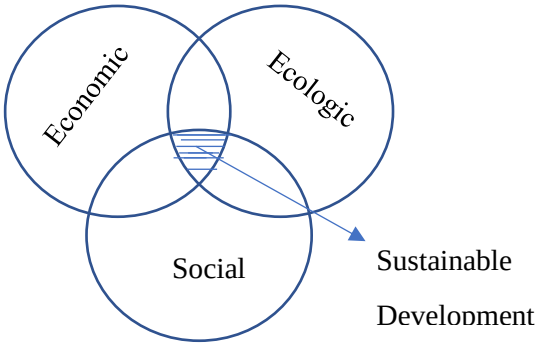

Figure 3: Triple Bottom Line

Sustainability has been defined as the ability of an organization to achieve its business goals and increase long term shareholder value by integrating economic, environmental and social opportunities into its business strategies *(Idowu, Capaldi, Zu, & Gupta, 2013)*. The organizations need a better understanding of what their resource base is and how this base can be regenerated, developed and renewed in order to have resources for doing business in the future. The question posed by all related studies is that how companies treat their resources and therefore, to explore what needs to be done to sustain the company's resource base. Sustainability focuses on two issues viz. environmental deterioration due to economic activities and at the same time the need for economic activities to alleviate poverty. What and How of Sustainability will always be an interesting thing to continue talking about and expressing views. But there is a larger consensus which has emerged over the years in differing studies regarding growing concern for the earth. The studies and researchers also focus on social circle of sustainability and therefore people as subjects — with their own needs and wants with a life beyond the organizations they work for or are associated with, as a stakeholder. Sustainable human resource management are those long-term oriented conceptual approaches and activities that are aimed at a socially responsible and economically appropriate employment practices (Thom & Zaugg, 2004). Sustainable human resource management is also defined as a pattern of planned or emerging human resource strategies and practices intended to enable organizational goal achievement while simultaneously reproducing the resource base over a long-lasting period of time (*Ehnert, Harry, & Zink, 2014*). From a Sustainable Work Systems perspective, the work related feedback and side effects like health problems are further explored to design work systems in order to '**develop' and 'regenerate' employees** instead of **'consuming' and 'exploiting' them** *(Docherty, Kira, & Shani, 2009*). An important principle in sustainable development is that the

technological innovation will not help achieve Sustainability goals and thus make the program as success *(Otoa, Cobanoglub, & Gerayc, 2012*). People in the organization should be aware of the sustainability agenda and how they can contribute. Sustainability Training is therefore a very key component and an important policy initiative to ensure success of sustainability agenda. Any training and education requirement for sustainability must involve themes from all circles of sustainability. Education for sustainability (EfS) means incorporating key themes of sustainability- such as poverty alleviation, human rights, equity, health and environmental protection - into all education systems- formal and informal. Sustainability at airport is achieved through sustainable education and training of employees, airport community personnel, customers, vendor partners, concessionaires, other stakeholders and the public at large *(Otoa, Cobanoglub, & Gerayc, 2012)*.

Sustainability at Airports

Airport, as a large system of systems, in terms of sustainability can be defined as Integrity of the **E**conomic viability, **O**perational efficiency, **N**atural resource conservation, and **S**ocial responsibility of the airport *((ACI), 2005).* Sustainability includes Ecological, economic and Social circles. *(Prather, 2016)* in his study related to sustainability practices talks about a holistic approach to managing an airport to ensure the integrity of the Economic viability, Operational efficiency, Natural Resource Conservation and Social responsibility **(EONS)** of the airport. He also draws attention to the importance of sustainability beyond green initiative or environmental aspects. As per EONS framework for Sustainability of Airports, there is an addition of one more element viz. Operational Efficiency, to the conventional definition of sustainability involving Economic, Social and Ecological. Thus, sustainability at airports can be said to be synonymous with EONS way of sustainability. The addition of operational efficiency ensures that even if there is no new construction is taking place, the sustainability issues can be addressed by business models which leverage operations capabilities to enhance sustainability. Sustainability is not just only for the construction or operational companies, but it is important for all over the world precisely *(Dalkiran, 2018)*. The management of the airport is mainly responsible for the environmental,

social, operational and financial effects of their decisions. The main idea for the Airport Management is minimum harmless decisions to sustain for long years. There is also a need to stress on the importance of reporting of sustainability parameters as one of the first criteria, to be a sustainable organization (*Dalkiran, 2018*). The meta concept of interfaces of an airport metropolis explains it as the synergistic coupling of core airport functions and airport orientated activities in the region. And this approach defines four interface domains as integral to the concept of an airport metropolis: Economic Development, Land Use, Infrastructure, and Governance *(Stevens, Baker, & Freestone, 2010)*. Based on current technical capabilities, a sustainable airport would meet the given nine criteria in alignment with United nations – Sustainable Development Goals *(Gabrielli, 2017)*:

1. Use of Environmentally Sustainable Design (ESD) Principles
2. Responsible Procurement
3. Maximise biodiversity
4. Minimal air, noise and light pollution
5. Zero waste to landfill
6. Minimal use of potable water
7. 100% green or renewable energy
8. Fossil fuel-free vehicle fleet
9. Carbon neutral by 2050.

While pursuing sustainability goals, it is important for airports to maintain a balance between all aspects so that they are self sustainable and following sustainable goals is in no way creates pressure for employees and community. Thus, it follows that an airport operator can have a sustainability definition which reflects its reality and context due to its unique circumstances. But it is generally expected that any definition would follow EONS framework.

Approach to Implementation of Sustainability at Airports:

It is of utmost importance for the airport operator to have an approach for sustainability program based on its context viz. size, geography, operating environment and resources available. The endeavour should be to try and establish how airport's sustainability program is connected to other such programs at local, regional, national and international level. As mentioned in *Sustainable Aviation resource guide*, a consensus based approach ensures success of sustainability program in the case of airport operations *((SAGA), 2009*). For sustainable development and progress at airports, a fine balance between environmental, economic, and social dimensions are required. For airports, this means that action on climate concerns, infrastructure growth and customer experience need to be managed in such a way as to avoid impairing each other's progress *(Gabrielli, 2017)*. Airport Organizations integrate sustainability plans into Airport Master Plan and also separately create a sustainability management plan. Integrating sustainability into airport master plan helps align sustainability and planning. Giving a structure to the entire sustainability program is one of the critical starting points and a key to success. Having a diverse team by including representation from all key departments and levels of airport organization along with representatives from concessionaire groups, tenant group, community groups, sustainability experts give a definite thrust and momentum to the entire program. Needless to say communication of roles, responsibilities, action plans, progress and feedback is an integral part of this program. In the endeavour to drive Sustainability Initiatives, the airports adopt a structure having Initiative Champion (The key driver for the initiative); Advisory Council (guides); Steering Committee (takes key decisions); Implementation Team (Action). With the approach steps as described below, the organization will be able to plan, implement, review, improve and maintain a sustainability program:

a) Formation of the team and assign key personnel

b) Sustainability vision, mission and establish guiding principles

c) Identify Focus Areas & key Goals

d) Conduct Assessment (as is)

e) Follow Cycle: Identify Initiatives, Prioritize, Action Plan, Implement, Monitor, Evaluate, Communicate Progress

Key Challenges in Achieving Sustainability:

When considering the application of sustainability airport-wide, it is important to recognize that airport management exercises varying degrees of control as explained:

- Those activities that the airport can directly control (e.g., infrastructure, operations)
- Those activities that the airport indirectly controls (e.g., contracts, concessionaires)
- Those activities that the airport influences (e.g., communities and passenger awareness).

Measurement of Sustainability at Airports

A very important question is, how to evaluate sustainability efforts of an organization in airport operations. There is a strong need to have a system and process to evaluate sustainability practices, initiatives and thus arrive at best practices, those which can be emulated across airports. When we talk about measurement and metrics of sustainability of airport operations, EONS Framework must always be referred and kept in mind. The EONS framework is an expansion of the triple bottom line concept (people, planet, and profit) that incorporates operational considerations at airports. Thus, any measurement or evaluation of sustainability efforts should ultimately tell us whether or how a practice relates to EONS framework of Sustainability.

Sustainability Categories: Broad organizational levels that group sustainability activities of a similar sustainability theme. We can look at eight categories to cover sustainability linked activities for airport operations: 1. Energy Conservation & Climate Change 2. Engagement and Leadership 3. Transportation 4. Water & Waste 5. Economic Performance 6. Natural Resources 7. Design & Materials 8. Human Well-Being

Sustainability Activities: High-level initiatives that have a strong potential to improve the sustainability of an airport. Under a sustainability category, there could be many sustainability activities. These activities are assigned a metric (to measure and track performance) and accordingly all activities are evaluated to finally adjudge the sustainability performance of airport operations *(ACRP- Sustainability Reporting System , Humblet, Steuer, Lemaster, 2014).*

Sustainability at Airports: Practices and Trends

The Airport Council International (ACI) defines airport sustainability as *a holistic approach to managing an airport so as to ensure the integrity of the economic viability, operational efficiency,*

*natural resource conservation, and social responsibility of the airport.*Sustainability issues has been categorized under three broad subject areas *(ACRP, 2008):*

Environmental practices: This includes water conservation, water quality, waste water management, air quality, biodiversity, environmentally sustainable materials, waste, noise, energy efficient, conservation of energy and green buildings etc.

Economic sustainability: This has topics ranging from financially prudent decision making to local purchasing and incentivizing sustainable behaviour.

Social Aspects: This has to do with issues related to social responsibility, areas related to education of communities and their well-being, stakeholder -relationships and communication, key employee practices and well-being, sustainable transportation, easing congestion, enhancing accessibility, promoting local culture and heritage, and passenger well-being.

Various practices followed by airports across the world are briefed below:

1. For Huntington Tri-State (HTS) Airport in US, the economic viability is achieved by allowing the airport to focus on cutting cost

2, The practice at Redmond (RDM) airport is that, in deciding between sustainability initiatives and financial responsibilities such as operations and maintenance, the airport's financial responsibilities must take priority.

3. Renton airport in US was able to reduce the cost of maintaining its landscape by replacing an existing mower with a faster and more fuel-efficient alternative. In this case, the investment in replacement equipment made sense by giving fuel savings and air quality enhancement.

4. The Green Apron Policy at Hong Kong Airport involves replacing the existing 43-vehicle fleet with alternative fuel over the next five years.

5. The Kempegowda International Airport, Bengaluru has invested in rainwater harvesting to meet the requirements of 100,000 passengers who fly daily. Rainwater discharge of about 1.7 million-litres capacity, is treated and reused. Excess water from these tanks is being used as an aquifer for adjacent lakes. Six abandoned wells have been rehabilitated, cleaned and repaired and with a recharge system in place. Fifty million units as required by the airport, are being powered through on-site and off-site solar Power Purchase Agreements (PPA) that now meet 67% of its annual energy requirements. The street and

perimeter lighting are completely powered by LED, providing enhanced safety for pilots, greater visibility for ground staff and reduce energy consumption, thereby helping BLR Airport save 11.5 lakh units of electricity annually *(Forbes, 2019)*.

Generally adopted Practices: Use of LED Lighting, Recycling old and waste materials, Rebates and purchase agreements for renewable energy usage, Replacing old and inefficient machinery/tools with new efficient tools, local hiring and purchasing policies, research to develop sustainable technologies, and incentives to encourage sustainable products , services and behaviour. Local and Responsible Economic Practices like hiring and procuring locally, by airport organizations, the concessionaires and other partners, Community Contributions, meaning hereby, there is a clear connection between a healthy business and the well-being of the community in which it operates. Valuing and Quantifying Sustainability Efforts includes Economic assessment of initiatives helps us choose the right initiative. Research and Development can also benefit airports through the implementation of new technologies, processes, and ideas. This includes areas like emission monitoring and solutions to tackle related issues, Energy efficient systems, process innovation and efficiencies. Giving Incentives for Sustainable Behaviour includes everything that has to do with altering behaviour by identifying patterns and thus influence stakeholders to follow sustainable behaviours and thus contribute towards success of initiatives. *(Berry, Gillhespy, & Rogers, 2008)*

Research Gap

From the past research work it has been found that there are few research works and little literature available regarding the sustainable management of airports. With respect to Indian Airports, it is much lesser. While the literature suggests that the dimensions of economic, ecological and social are used to drive sustainability globally, the sustainability focus in India continues to be compliance propelled and largely confined to environmental domain and restricting the social domain to the donations and contributions.

Section III

Conceptual Framework and Hypotheses

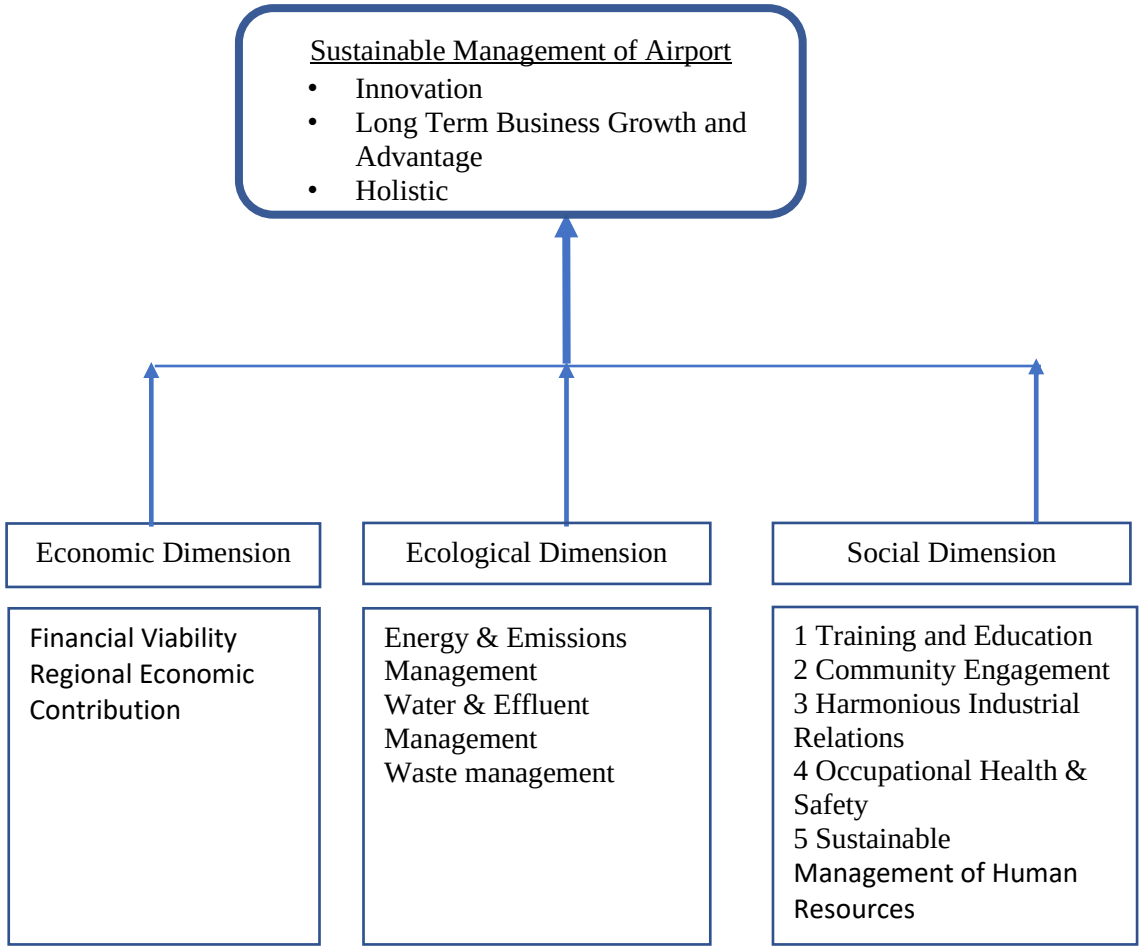

Figure 4: Conceptual Framework

Sustainability and Innovation

Various studies and research have shown that sustainability is a mother lode of organizational and technological innovations. It leads to both bottom line and top line returns. When a company becomes environment friendly, the cost is reduced. The additional revenue comes from better products or services. When sustainability is treated as equal to innovation, the company takes a giant leap and gives a competitive edge, which forces companies to change the way they think about products, technologies, processes. Innovation is the only way to leadership especially keeping in view tough economic conditions and ecological mandates. Companies that think ahead of time, focus on meeting emerging norms and gain more time to experiment with materials, technologies, and processes rather than mere compliance to current norms in the marketplace *(Ram, Prahlad, & Rangaswami, 2009)*. Sustainability is a business

opportunity, an investment for the future and a pathway for innovation and creative thinking. Sustainability has considered of a cycle to develop by innovation and redesigning activities for reduce environmental effects and improving the financial stability to reducing costs and improving the profit for the facilities *(Dalkiran, 2018)*.

Sustainability as a Holistic Approach

Sustainability must be addressed in a holistic way by integrating the dimensions of economic, environmental, social and time, as well as their interconnections. Sustainability must be embedded holistically into the corporate business model so as to create value for the company. The sustainable business model refers to Integrating organizational approaches, the company system, stakeholders, change and sustainability dimensions and thus provides a more holistic and systemic approach *(Lozano, 2018)* . Sustainable development as a holistic vision means changes at all levels viz. social, economic, political, and cultural. Thus, sustainable development is that development which allows us to meet the needs and aspirations of both present and future generations always in a concrete social-historic and environmental context without undermining the capacity of nature and cultures for self-regeneration, while giving special attention to the eradication of poverty, social injustice, and inequalities. This holistic idea of sustainable development does not suggest a return to the pre-modern technology stage nor the stagnation of society *(Neuto & Neotropica, 1997)*.

Sustainability as driver of long-term business growth

Sustainability initiatives lead to operational benefit and drives strategy by adding the dimensions of social and environmental in the mission of organization. Running a sustainable business that is also profitable is a challenge and is tough. All that is needed for this is to translate the traditional vision of business profitability to one of broader social impact. The opportunity is there to create a new future by including the principles of sustainability into the strategic action plan. With the growing focus on the integrated and holistic approach involving people, planet, and profits, the right balance between short-term and long-term priorities will help create enhanced value for stakeholders *(Gurnani, 2020).* Building a sustainable enterprise result in creating long term value. The three pillars of sustainable products and value chains, sustainability culture, and integration into the operating model, should help promote the most effective

transformation. The final two pillars comes after these three pillars and those are:- positive reputation and capital market access and thus long term value is fully realized *(Eitelwein & paquet, 2021)*.

The Sustainability Dimensions:

Airports support sustainability by ensuring return on investment and operational lifecycle factors, protecting and enhancing the natural environment and engaging their stakeholders and community. The economic, ecological or environmental and social dimensions impact the sustainable management of airport. These there dimensions affect the sustainability through the key sub dimensions as mentioned in the figure 6. For sustainability, all the three factors namely financial sustainability, social sustainability, and environmental sustainability are critical. The role of an airport to a nation's economy is highly significant and needs to be considered when deciding about airports future. The endeavour is to reduce the adverse effects that airports may have and execute plans that maximise the social and economic benefits. Therefore, the effort has to be made in direction that leads to green growth of the airport, in which environmental burden is highly reduced. Developing an effective sustainable approach to manage airport, points to considering the social , economic and environmental factors *(Sameh & Scavuzzi, 2016)*. Airport sustainability should include reducing environmental impact, ensuring rapid and stable economic development, and promoting social progress *(FAA, 2019)*. Sustainable development has three key dimensions viz. economy, environment, and society *(Welford, 1995)*. Sustainable transportation development includes financial, economic, environmental, and social dimensions. *(Bartle, 2006)*. The financial dimension refers to the generation of funds to cater to capital needs and operating costs. For an airport, it means that the airport can guarantee the economically feasible operations. The economic dimension also means, achieving the highest social return on physical and natural capital. This means the operating efficiency of airport. Improving airport efficiency is an important means to promote the sustainable development of aviation. *(IATA, 2019)*. Thus, the economic dimension also describes the operating features of an airport and can also be referred to as operational dimension. The environmental dimension refers to the integration of environmental concerns into transportation. The social dimension refers to improving standard of living, quality of life, and reducing poverty. Social sustainability practices by an airport has a major impact on its relationship with the community. The objective is to have good relations with all stakeholders, including passengers, employees, airlines, and residents of neighbouring

areas. The category includes stakeholder relationships, employee practices and procedures, transportation practices, indoor environmental quality, and the well-being of employees and passengers *(Berry, Gillhespy, & Rogers, 2008)*. The social sustainability also relates to human well-being and includes many activities, like employee training & development, Industrial relations, Community relations, and Diversity and Inclusion. No one activity can capture all of the most important elements of human resources and employee well-being *(Lurie, Steur, & Lemaster, 2014)*. In the environmental dimension, the various aspects are energy management, emissions management, water and effluents management, solid waste management. The noise management, employee development, and community engagement belong to the social dimension. Similarly, the factors such as economic contribution, passenger experience, airport safety, and security are inclined to economic dimensions of sustainability. Environmentally sustainable practices have greater importance than social and economic initiatives in the airport context which provide quantifiable benefits for airports in the long term. These sustainability dimensions are valuable for airports striving to achieve sustainability goals *(Sreenath, Sudhakar, & Yusop, 2021)*. Therefore, it is hypothesized:

H1 →The better the performance on the economic dimension, the higher will be the sustainability of the airport.

H2 →The better the performance on the ecological dimension, the higher will be the sustainability of the airport.

H3 → The better the performance on the social dimension, the higher will be the sustainability of the airport.

Better economic condition

Airports require huge capital investment and must grow profitably to sustain. Airports must generate acceptable returns for investors, which means airports must maximise revenue from non-aviation activities to mitigate the risk of losing an airline or finding that plans have been based on overly optimistic passenger forecasts. Airports must produce sufficient revenues to exceed all direct and indirect operating costs and so provide for a reasonable return on assets at a sufficient level to secure efficient financing from market *(ICAO, 2013)***.** Economic considerations and parameters span across all sustainability activities. Therefore, the financial conditions become very important aspect which is related

to any activity that an airport pursues and impacts the economic condition of the airport. The economic conditions of an airport are impacted by financial agreements which are socially principled, environmentally beneficial, ethical, and based on identified mission themes of the airport organization. While making socially responsible investment decisions, the airport revenue should not be diverted to other businesses and should be used to further the mission themes as set by the airport organization. Financial sustainability relates to efficiencies in capital costs, operation, and maintenance to optimize the financial performance of an airport. It ensures long-term financial viability. The airport should be able to finance its capital needs and cost of operations to meet existing as well as rising demand. Financial performance of an airport influences its economic decisions, including an airport's long-term risks and opportunities and thus impact its sustainability *(Lurie, Steur, & Lemaster, 2014)*. Therefore, it is hypothesized:

H1a →The better the economic condition of the airport , the higher will be its sustainability.

Regional Economic Impact

Airports have played a major role in many parts of the world in allowing economies both national, and regional, to realize more of their economic potential. Airports do not just appear in markets. They are planned and their operations are carefully regulated by the local, national and in many cases, the international bodies. At the macro level, there have been intensive debates about the role of infrastructure in enhancing the economic productivity of a country or a region. Many airports have undergone studies related to full regional economic impact assessment of an airport. (RK, 2007) (Kiernan & Butler, 1992). The task is not an easy one. Measuring local economic impacts of airport investment is challenging and studies have often overestimated them. The airport infrastructure in a region leads to different kinds of impacts as mentioned below:

1. Primary: Short Term advantages to the region due to income generation and employment generation
2. Secondary: Other advantages include taxation revenue due to connected businesses like Cargo etc.
3. Tertiary: The regional economy also gets boost by way of hub and spoke model of connectivity i.e, major airport connecting a smaller airport. The cargo operations help also drive the economy.
4. Perpetuity Effect: These reflect the fact that economic growth, once started in a region, becomes self-sustaining and may accelerate. An airport can change the entire economic structure of a region – it

can shift its production function and can lead to start of many other industries which are connected globally. This type of dynamic economic impact of an airport is the most abstract and the most difficult to quantify.

Airports also influence a locality's amenities by promoting local and regional economic development (Kasarda & Appold, 2014). Airport influences local economies with sources of employment. In addition to benefitting local economic development by promoting employment growth, the airport also contribute to the development of local economies by increasing the value of commercial property (Bitzan, 2017). The presence of an airport in a region can be an important strategic asset in solving problems of economic and territorial growth, it is endogenous and exogenous in nature, contributing to the supply chain, of new business, and leading to significant increase in employment. The presence of an airport can improve the proliferation of tourist activities. Improved access to an airport is an important factor and can result in the production of tourist services with advanced methods that can support significant events including those of sports, culture and congress. The airport generates economic value on two fronts: As an economic activity, it is the product of the concentration of investments and the provision of services related to air traffic management, administrative management, and accounting of the airport. As a support facility to the regional economy, it can provide businesses and the public with a means of quick and reliable transportation to develop business, trade and offer services that can enhance the accessibility of national, international and intercontinental area (Amoroso & Caruso, 2010). Therefore, it is hypothesized:

H1b →The higher the impact on the economic growth of the region in which the airport is located, the higher will be its sustainability.

Energy & Emissions Management

The most critical environmental issue faced by aviation industry and airports is the harmful effects on the climate. Aircraft emission leads to multiple negative effects on the quality of air that we breathe, and also on the climate and ultimately depletes the ozone layer. The harmful gases and other particulate emissions from aircraft and other vehicles at the airport impacts human body badly. The degradation in air quality at airports is highly damaging to human body. Various environmental impact studies reveal that the particulate matters, NOx, HC, SOx, and CO from aircraft engine emissions can affect air quality, well-being and overall health of individuals especially those living around the airport. In addition to the

aircrafts, ground support vehicles and equipment also contribute to the emissions at the airport. Both the ground service vehicles as well as the airport surface access systems are taken together as part of the environmental burden of the airports *(Sameh & Scavuzzi, 2016)*. By doing environment management of various activities undertaken at the airports, the sustainable management and development is ensured and a balance is tried to be established where growth takes place keeping in view overall sustainability. Energy has importance not only as a main source for operation of any unit but also as a key cost item. In terms of energy consumption patterns, airports consume as much energy as any small town. Main energy consuming system and processes at airports are, Navigation aids, runways lights, maintenance facilities, apron lighting, terminal lighting, shops and other establishment at airport, HVAC system etc. This makes a perfect case for efficient use of energy and work towards the conservation *(Altuntas, karakoc, & Sogut, 2016)*. The expected exponential growth in air transport will add to the global warming. Activities at the Airport contribute adversely and greatly to the overall climate change. Airports can play a significant role in reducing the impact of the activities on climate change by addressing emissions in ground transportation, energy use in buildings, and associated indirect emissions *(Berry, Gillhespy, & Rogers, 2008)*. The airports cause significant environmental impacts and therefore increasingly, airports are being managed keeping in view the sustainable development guidelines in order to satisfy the demands by various stakeholders *(Sehyani & Vildan, 2015)*. Therefore, it is hypothesized:

H2a →The more efficient the management of energy and emissions at the airport , the higher will be its sustainability.

Water & Effluent Management

The tremendous growth in the airport sector has led to a significant increase in water usage. Airports also generate high volumes of wastewater that may include contaminants. Hence, understanding sustainable water management practices is essential for the airports sector. Water consumed by airports can be broadly divided into the water consumed directly by the airport as well as its partner network. These partners consume water for many purposes. These include, drinking water, washing, toilets, cooking. Water is also used for maintenance of landscaping. Thus, it is important to note that considering the increasing pressure to reduce water consumption and conserve available water resources, airports must manage their activities and operations to reduce water consumption. Wastewater can be collected by the

airport, treated, and subsequently reused for activities including toilet flushing, washing, and watering of plants. Having a strategy to recycle and reuse as much water adds to the sustainable management of airport *(Baxter, Srisaeng, & Wild, 2018)*. Sustainable water management has become a subject matter of concern and importance for airports all around the world. Airports not only consume large amounts of water (which needs to be managed well), but also generate significant volumes of waste and drainage waters (which needs to be processed in an environmentally friendly manner) *(Baxter, 2022)*. Along with the rainwater harvesting and water quality measurement techniques, the sustainable water development program at airports may include, Lake rejuvenation and increasing the water table (BIAL, 2021). Therefore, it is hypothesized:

H2b →The more efficient the management of water and effluents at the airport , the higher will be its sustainability

Waste Management

Airport generates lot of waste due to its activities and may relate to passengers or other actors and stakeholders. Waste is also generated due to other operation and maintenance and construction. The airport is said to be having efficient waste management practices, if the waste generated by airport is minimal. Many activities at airport may result in the discharge of pollutants to adjacent water bodies and trigger harmful impact on aquatic life and human health *(Sameh & Scavuzzi, 2016*)

Waste reduction is achieved by stopping materials, generated at airport, from entering the solid waste stream by a set of airport actions. Waste Reduction and management is measured by reduction in solid waste production. This includes solid waste at airports like paper, food items, metals, glass, plastics, biomass, wood, and electronics items *(Lurie, Steur, & Lemaster, 2014)*. Waste management at airports is thus becoming very important. Airports are generally bad performers on ecological parameters and the high growth in the industry is leading to increasing levels of waste production. Environmentally sound waste management goes beyond the safe disposal of wastes and look at the root cause to change patterns of production and consumption and make them more sustainable. Reuse and recycling of materials can reduce consumption of materials, as well as the amount of waste sent to landfill. Ensuring that materials used at airports have low environmental impact and do not harm human health is paramount for achieving sustainable outcomes at an airport. *(Berry, Gillhespy, & Rogers, 2008)*. Therefore, it is hypothesized,

H2c →The more efficient the management of waste at the airport, the higher will be its sustainability.

Education & Training

The airports must ensure that all stakeholders working at the airport have the requisite knowledge and skills necessary to work in a sustainable manner. It is generally observed through various studies that while environmental training is given to those working at airport, the economic and social sustainability training is mostly missing *(Berry, Gillhespy, & Rogers, 2008)*. To build the staff capacity at the airport, training and educational opportunities must be provided. Competent employee and associates at the airport use their knowledge, skills, and abilities to enhance organizational performance and increase employee satisfaction. This includes sustainability awareness training and sensitivity trainings on issues of diversity and so on *(Lurie, Steur, & Lemaster, 2014)*. Though education and training have always been integral to effective airport operations its significance has certainly increased in recent years due to global competition for passenger, cargo and economic development. An airport can become world class if employees and associates receive required training to acquire knowledge and skills to manage safe operations and increase efficiency. Training and education should be a ongoing effort by an airport. Transportation professionals also face unique challenges when working to provide services to passengers with special abilities in a safe and dignified manner. Assisting passengers with transfers on sloped surfaces and in the confined spaces of vehicle cabins is extremely difficult and challenging due to the physical characteristics of passengers and space constraints (Quilty, 2003). Therefore, it is hypothesized:

H3a →The better the focus on training and upskilling of people working at airport, the higher will be its sustainability

Community Engagement & Leadership

Airports must engage with stakeholders, partners, concessionaires to get useful information from employees, partners or groups that are affected by airport activities. Airports also must follow a Public outreach process in which they engages in two-way communications with surrounding communities and regions. Any sort of community opposition to airport operations and development can lead to project delays, unanticipated costs, and litigation. Airport noise, both from aircraft and non-aircraft sources (construction), is a matter of great concern to surrounding communities. The excessive, misdirected, or

obstructive artificial lighting from airport creates light pollution and needs to be managed so that living conditions for the neighbouring communities are improved *(Lurie, Steur, & Lemaster, 2014)*. Airport operators rely heavily on community engagement to mitigate environmental constraints to operate and grow sustainably. If airports fail to maintain good and harmonious relations with the neighbouring communities, it can result in political and social pressure against the operation and further development of the airport. If engaged properly, the communities tend to understand and appreciate the role of airport and pressure it faces to facilitate aviation industry and steps taken by airport to address concerns and issues. Communicating with the communities help to informed and educate them and develop trusting relationship with them. The engagement includes providing information to communities about running of airport and its further development. Aircraft noise is the biggest concern. However, other ecological issues like air quality, greenhouse gas emissions, land use, and waste management also needed to be spoken during community engagement *(Xavier, 2016)*. The airports must use easily understandable environmental and operational data to engage with communities on a regular basis to strengthen their social licence to operate in the vicinity. The airports must tailor community engagement experience *(ACI, 2020)*. Therefore, it is hypothesized:

H3b → The higher the level of positive engagement with the stakeholders, partners and neighbouring community of the airport, the higher will be its sustainability

Industrial and Employee Relations:

Industrial Relations refers to the constructive dialogue between airport management and employee associations to mutually agree upon productivity goals with a reasonable quality of life. The areas of dialogue mainly include reasonable compensation, benefits and other basic needs. Benefits comprises of health insurance, retirals, creche and day care program, wellness programs, transportation assistance, and onsite amenities). Fair treatment of employees includes the incorporation of anti-discrimination and equal opportunity policies. This creates more chances of employee retention and minimizes the risk of unrest or Industrial Relation issues at the airport. Any kind of unrest can disrupt airport operations having manifold impact on other airports and can severely threaten airport security *(Lurie, Steur, & Lemaster, 2014)*. The industrial relations or relations with people working at the airport, can be segmented into three levels: a) workplace; b) collective bargaining; and c) strategic decision making. The first level is

facilitated and governed by the way employees and managers interact keeping in view HR approaches, policies and programs. Collective bargaining defines the structures and processes of how unions and firms negotiate and reach an agreement to implement the agreed standards that define many basic employment terms, such as salary and wages, working hours and conditions and disciplinary procedures and so on. The strategic decision making refers to the extent to which employees or their representatives/ groups participate in the governance and management of the airport. There are interactions between the different levels. Collective bargaining can shape workplace interactions, and the nature of workplace interactions can influence the tone and culture of collective bargaining *(Gittell, Andrew, Kochan, Mckersie, & Bamber, 2009)*. Therefore, It is hypothesized:

H3c →The more harmonious the Industrial Relations scenario is at the airport, the higher will be its sustainability

Occupational Health and Safe Workplace

Occupational and workplace hazards are potential harm or adverse health effect on individuals under occupational conditions and are mainly caused due to the kind of work performed by the person and may include tasks, conditions, substances and materials, and equipment. At airport, it includes noise exposure, exposure to pollutants and so on. Other concerns include the operation of machines by crew, baggage handling by agents at different touch points, assisting passengers with Critical care needs, the potential transmittal of diseases and lighting and ventilation issues. Airports must monitor and mitigate all these hazards and work with employee and associate groups to ensure health and safety for all. This also helps airport organization by improving productivity levels and reducing overall costs by way of reduction in compensation, reduced medical visits, reduced investigations etc. Airports must ensure that the health of employees and associates using different materials and equipment is not affected adversely. This is important for achieving sustainable outcomes at an airport. As a practice, health and wellness programs incorporates nutrition, exercise, and education to improve health and reduce sick time. *(Berry, Gillhespy, & Rogers, 2008).* A very major component of the development of any organization is centred around employee to be healthy, productive and motivated. The organizations must realize that the healthy production of materials, goods and services can only be achieved if the health, safety and well-being of the working population is ensured *(Boileau, 2016)*. Therefore it is hypothesized:

H3d →The more effective the occupational health and safety management is at the airport, the higher will be its sustainability.

Sustainable Management of Human Resources

Human resource professionals play a very important role in the organization's journey to become sustainable. For ensuring that the sustainability program is a success, the HR professionals should be involved in creating and implementing the sustainability strategy. Executing sustainability initiatives requires, breadth and depth of connection in the organization and the ability to affect the right levers in organization. The HR professionals are rightly placed for this *(SHRM, 2011).* Sustainable human resources management is defined as the HRM strategies and practices that enable the achievement of financial, social, and ecological goals, with an impact inside and outside of the organization and over a long-term time horizon while controlling for unintended side effects and negative feedback *(Ehnert, Parsa, Roper, Wagner, & Camen, 2016)*. Sustainable Human Resource Management is a new approach to Human Resource Management (HRM) that links HRM and sustainability. Sustainable HRM refers to social and human outcomes which contribute to the long term sustenance of the organization. Sustainable HRM also refers to HRM activities which enhance positive ecological outcomes i.e, Green HRM. Sustainable HRM concerns either explicitly or implicitly with human and social outcomes of the organisationand has a huge impact on the survival and success of the organisation *(Kramar, 2013)*. The role of Sustainable HRM is to foster regeneration and development of the workforce and HR base. HR mainly addresses, 1 Any Shortage of skilled and motivated people 2 Degeneration of employees due to work 3. Relation between HRM and its environments concerned with achievement of sustainability goals *(Ehnert I. , Sustainability and HRM, 2011)*. People working at airport face a variety of stress factors their daily work lives. These factors include but are not limited to 24/7 operations, long distance travel, dealing with customers with a focus to create high level of satisfaction, changes in the organization and technology, and security or safety concerns resulting from the type & location of the work. If these factors are not addressed in time, attracting, building and retaining employees become difficult. Airport organizations that work towards decreasing stress for employees create an environment in which employees want to work and can thrive and self-actualize. Well-being as a concept has multiple components which includes physical, mental, social, and financial well-being. Varying well-being

programs are used by airports to ensure the well-being of employees *(Alexander, Solook, Iliav, & Warner, 2020)*. Therefore, it is hypothesized:

H3e → The more sustainable the human resource management practices are at the airport, the higher will be its sustainability.

Research Hypotheses:

H1: The better the performance on the economic dimension, the higher will be the sustainability of the airport.

H1a: The better the economic condition of the airport, the higher will be its sustainability.

H1b: The higher the impact on the economic growth of the region in which the airport is located, the higher will be its sustainability

H2: The better the performance on the ecological dimension, the higher will be the sustainability

H2a: The more efficient the management of energy and emissions at the airport, the higher will be its sustainability.

H2b: The more efficient the management of water and effluents at the airport , the higher will be its sustainability

H2c: The more efficient the management of waste at the airport, the higher will be its sustainability.

H3: The better the performance on the social dimension, the higher will be the sustainability of the airport.

H3a: The better the focus on training and upskilling of people working at airport, the higher will be its sustainability.

H3b: The higher the level of positive engagement with the stakeholders, partners and neighbouring community of the airport, the higher will be its sustainability

H3c: The more harmonious the Industrial Relations scenario is at the airport, the higher will be its sustainability

H3d: The more effective the occupational health and safety management is at the airport, the higher will be its sustainability.

H3e: The more sustainable the human resource management practices are at the airport, the higher will be its sustainability.

Section IV

Overview of Proposed Research

In this section, an overview of the proposed research is explained in terms of the need of the study, objectives, research design, tools and methodologies.

Need of the Study

As discussed in the earlier sections, Airport is a key part of air transport infrastructure and airport operations has a huge impact on the sustainability in terms of economic, social and ecological dimensions. Airports are highly complex system of systems. The ecological or environmental aspects take precedence and form a key part of overall airport management strategy. The economic elements also get addressed to satisfy the involved stakeholders. No environmental initiative is taken forward, without a proper economic analysis. Whereas environmental issues are in top of the minds of strategists and planners, there is less than optimal focus on the social aspects. Largely it has remained confined to Corporate Social Responsibility and neglects the community outreach for the personnel working at airport premises. And in this context comes issues related to Employee health and safety, Skills of the workforce, Work-life-balance, Employee Diversity, Trust and employer trustworthiness, Social responsibility, Employee Degeneration and so on. We still know too little about how to deal with people in a way that advances sustainability in terms of all three circles, and that how it enables sustainable development. There are only a very few studies which were found, related to progresses made and approaches followed towards sustainability in Indian Airports and all such studies are largely focused on environmental aspects. The social aspect receives low priority by airport organizations especially beyond discharging responsibilities as regulated by law and that itself suggests that we are still at a very nascent stage of sustainable management of airports in India. During the review of literature, it was found that questions related to sustainable management of airports constantly trigger mind of researchers and thus the effort to explore the topic further. Further, this is not extensively researched topic , especially in the Indian context. The earlier research efforts also, has, not deeply focused on the meaning and application of sustainable management of airport and the sustainable development of communities, especially in and around Indian airports. Overall, the study will endeavour to throw light on sustainability related governance, approaches, framework and practices, in Indian context. The study will bring out various aspects and provide insights

regarding the prevalence and state of sustainability dimensions at Indian airports and how these can be further enhanced to ensure sustainable management of the airport.

Objectives of the Study

In view of information and subsequent interpretation of that information as discussed in the previous sections, the present research will aim to achieve the following objectives:

Objective 1: To study in detail the sustainability at the Indian airports using the key dimensions framework.

Objective 2: To develop a hierarchical structural model to understand the sustainability as a practice in Indian airports.

Objective 3: To study and examine the relative impact and importance of different dimensions on sustainability of Indian airports.

Objective 4: To study and understand the link of Sustainable Management of Airport with human resource management.

Objective 5: To recommend relevant policies, strategies and initiatives that can help enhance sustainable management of airports in India.

Nature of Study:

This research will be descriptive and analytical in nature. The study is descriptive because it studies the present state of sustainability at the major Indian Airport. The study is analytical as it will analyze and evaluate the dimensions of sustainability and its impact on sustainable management of Airport in Indian context. In addition to the survey-based research, the study will also use case study based research and a narrative framework to frame recommendations for policies.

Scope of the Study:

In order to collect data, researcher will select public and private major civil airports from India. The important factors considered for selecting the airports: **a)** Scale and Size of operations **b)** Regional Coverage **c)** Type of Airport: Public Private(PPP), Government (Govt) **d)** Project Stage: Greenfield, Brownfield Airport

Name of Airports for Survey Research

Table 1 Name of Airports for Survey Research

Category	Name of Airport
PPP	Indira Gandhi International Airport, New Delhi
PPP	Chattrapati Shivaji International Airport, Mumbai
PPP	Rajeev Gandhi International Airport, Hyderabad
Govt.	Chennai International Airport, Chennai
PPP	Kempegowda International airport, Bengaluru
PPP	Cochin International Airport, Kochi
PPP	Goa International Airport, Goa
Govt.	Netaji Subhash Chandra Bose International Airport, Kolkata
PPP	Noida International Airport , Jewar

The airports chosen above in the table for the survey research, represents regional diversity in India i.e, East, West, North and South. It also involves airports which are handling major passenger numbers and air traffic movements. The selected airports also represent both public and private major airports and also include airports which are under full project phase, half project phase and full operation phase.

Data Source and Data Collection:

Researcher will focus on primary data (using questionnaire method) to analyze the dimensions and various sub dimensions that impact sustainable management of airport in India. The researcher will include the secondary sources of data in the form of gathering published materials such as extracts from relevant journals and papers related to the study. It also includes Reports, Books, Blogs, Periodicals, Websites and other online resources covering the present study as secondary source.

Sampling Techniques:

The judgmental and convenience sampling technique will be used to collect information and data from people working with and associated with the mentioned airports.

Sample Composition

The proposed sample plan is as follows in the table below:

Table 2 Sample Composition

Delhi	Mumbai	Bengaluru	Chennai	Kolkata	Hyderabad	Cochin	Jewar	Goa	Total
80	50	150	30	20	50	20	10	30	440

The sample will be collected from middle to senior management personnel form the identified airports , especially having knowledge of the domain of sustainability.

Sampling Design:

A good sample is true representative of the population. For this study, judgmental (non-probability sampling) will be used to draw appropriate representative sample from the population. The researcher will take India as a country for studying and data will be collected from the airports as mentioned in this section.

Sample Size Calculation:

Taking a statistical approach for calculation of sample size, the various quantitative measures to be considered while determining the sample size are as follows:

a) Variability of population characteristics or standard deviation (σ)

b) Level of confidence desired or Z value (taken as 1.96 for 95% confidence level desired)

c) Degree of precision desired in estimating population characteristics (D)

$$n = \sigma^2 Z^2 / D$$

In the above formula, n = sample size , σ = Standard deviation

Z = Standard normal variate for 95% confidence level

D = Degree of precision desired

In order to obtain a representative and realistic sample size, results are compared across the three scenarios which have been considered:

Scenario 1: Estimating a low standard deviation and high value of precision range

Scenario 2: Estimating a moderate standard deviation and moderate degree of precision

Scenario 3: Establishing a high standard deviation and low value of precision range

The results are summarized below in the table:

Table 3 Sample Composition

	Scenario 1	Scenario 2	Scenario 3
σ	0.8	1	1.2
Z	1.96	1.96	1.96
D	0.16	0.14	0.12
n	96	196	384

Average, n = (n1+n2+n3)/3

n = (96+196+384)/3

n = 225

Since the population is finite, finite population correction factor (f.p.c) is applied to get the final sample size,

Final sample Size = n * √(N-n) / √(N-1)

N- Population (440 expected respondents)

Putting n=225 and N= 440

Final sample Size =225 * √(440-225) / √440-1)

= 157.55

Final Sample Size = 158

Statistical Tool for Analysis:

Relevant analytical tools like regression, correlation, ANOVA would be used. To test the given hypotheses and survey findings scientifically, researcher is keen to analyze the data using appropriate statistical tools like, correlation, descriptive statistics etc. Tools of systems analysis will also be used to understand the complex topic of research.

Section V

Chapterization

The thesis will contain following chapters:

Chapter 1 – Introduction

Chapter 2 – Review of Literature

Chapter 3 – Conceptual Framework

Chapter 4 – Research Design and Methodology

Chapter 5 – Data Collection and Analysis

Chapter 6 – Results and Interpretations

Chapter 7 – Conclusions, Managerial Implications, Limitations and Directions for Future Research

Chapter 8 – Bibliography and References

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